

**AMENDMENT TO THE DRAWINGS**

With this Amendment, Applicant concurrently submits a formal replacement drawing of Figure 1. Applicant submits that there is no new matter submitted with this replacement drawing.

Applicant is concurrently filing a petition under 37 C.F.R. 1.84(a)(2) for the replacement and submission of Figures 8 – 9 as color drawings.

**REMARKS****I. INTRODUCTORY REMARKS**

The Applicant thanks the Examiner for the careful consideration of this application. The Office Action dated April 14, 2008 has been received and its contents carefully considered. Applicant amended the specification to reflect the renumbering of the drawings. Claims 1-16 are currently pending in this application. Based on the foregoing amendments and the following remarks, the Applicant respectfully requests that the Examiner reconsider all outstanding rejections and that they be withdrawn.

**II. CLAIM REJECTIONS UNDER 35 U.S.C §112**

On page 2 of the Office Action, claims 1-16 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. More specifically, the Office Action provides that the "claims contain numerical limitations (e.g., Claim 1 contains '(1)', '(3)', and '(10)') which refer to descriptions in the specification." Applicant amends the claims to remove all numerical limitations referring to the description in the specification. The claims have additionally been revised to clarify the subject matter Applicants regard as their invention and to conform with USPTO practice.

In view of the above amendments, it is believed that claims 1-16, as amended, are clear and definite within the meaning of 35 U.S.C. § 112, second paragraph. The Applicant therefore respectfully requests that the rejections under 35 U.S.C. § 112, second paragraph, be reconsidered and withdrawn.

**III. CLAIM REJECTIONS UNDER 35 U.S.C. § 103(A)**

On page 2, the Office Action addresses the requirements for joint inventorship. Applicant asserts that the subject matter of the various claims was commonly owned at the time any inventions covered therein.

On page 3 of the Office Action, claims 1-16 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Applicant's Admitted Prior Art (AAPA) in view of U.S. Patent No. 4,451,299 to Smeggil et al. At the top of page 4 of the Office Action, claims 2, 4, and 6 – 16 are rejected under 35 U.S.C. § 103(a) as being unpatentable over AAPA in view of Smeggil, and further in view of U.S. Patent No. 5,232,674 to Mukai et al. At the bottom of page 4, claim 12 is rejected under 35 U.S.C. § 103(a) as being unpatentable over AAPA in view of Smeggil, and further in view of U.S. Patent No. 6,670,575 to Wrba et al. The Applicant respectfully traverses these rejections for the following reasons.

**A. AAPA AS COMBINED WITH SMEGGIL ET AL.**

On page 3 of the Office Action, claims 1-16 rejected under 35 U.S.C. § 103(a) as being unpatentable over Applicant's Admitted Prior Art (AAPA) in view of U.S. Patent No. 4,451,299 to Smeggil et al. Applicant respectfully traverses this rejection.

The present invention relates to a method for smoothing and polishing surfaces, such as the surfaces of finishing tools and molds. According to claim 1, the method for smoothing and polishing surfaces includes treating a to-be-smoothed surface in a first treatment step by "remelting the to-be-smoothed surface using energetic radiation while employing first treatment parameters at least once down to a first remelting depth which is greater than a structural depth of to-be-smoothed structures of said to-be-smoothed

surface, wherein the using of energetic radiation includes using continuous energetic radiation or pulsed energetic radiation with a pulsed duration of  $\geq$  to 100  $\mu$ s such that said surface is remelted down to a first remelting depth of about 5-100  $\mu$ m.”

The Office Action suggests that claims 1-16 are unpatentable over AAPA in view of Smeggil et al, and generally refers to the AAPA described in the specification as prior art at pages 1-3. Applicants believe that the closest prior art mentioned in the application may be represented by German patent document DE197 06 833, which describes a method for smoothing and polishing surfaces utilizing laser radiation having a pulse duration of between 10 ns and 10  $\mu$ s to a depth of 2-3  $\mu$ m with each laser pulse. The present invention takes off from such prior art to provide a method for smoothing and polishing surfaces by treating with energetic radiation with the advantage that the claimed method does not require expensive measuring instruments and can be used to automatically polish any 3-dimensional surface, in particular metal surfaces, quickly and inexpensively.

The disclosure of Smeggil et al is directed to an entirely different process which is to improve the oxidation resistance of protective coatings deposited on an article (see Abstract or Claim 1, for example). Indeed, Smeggil et al are completely silent about smoothing or polishing surfaces. The process in Smeggil et al includes preheating an article to a temperature above its brittle to ductile transformation temperature using a concentrated source of heat energy to rapidly melt a portion of the coating so that upon the resultant rapid solidification, a refined super-saturated material capable of forming a continuous protective oxide scale, results (See Claim 1). Accordingly, it is not seen why one of ordinary skill in the art would consult Smeggil et al for teachings relating to polishing and smoothing surfaces.

Aside from the fact that the disclosure of Smeggil et al does not contain any hint or link to a method for polishing or smoothing surfaces, it is respectfully submitted that the disclosure of Smeggil et al is deficient as to salient features of the invention as recited in Claim 1, even if Smeggil et al were considered by a person skilled in the art of polishing and smoothing surfaces. In particular, Smeggil et al is silent about a remelting depth which is greater than a structural depth of to-be-smoothed structures of the to-be-smoothed surface. Further, Smeggil et al are silent about the surface being remelted down to a first remelting depth of 5-100  $\mu\text{m}$ . While the method for improving the oxidation resistance of high temperature coatings in Smeggil et al employs a partial melting of the surface of the coating, in the example set forth at column 4 of Smeggil et al., the melting is varied from about 2 to about 5 mm, a totally different range from that claimed. Further, Smeggil et al are completely silent about a continuous energetic radiation or pulsed energetic radiation with a pulse duration of  $\geq 100 \mu\text{s}$  as recited in Applicants' Claim 1.

Furthermore, Applicants respectfully disagree with the conclusory statement at page 3 of the Office Action whereby it is suggested that the "claimed pulse duration times and remelting depths would have been obvious at the time applicant's invention was made....because particular materials require different particular process parameters and because developments in the laser art has provided a greater range of parameters useful for surface treatments." With all due respect, this generalization is unfounded and in any event, has no relevance to the "particular" surface treatment claimed in the present application. Namely, applicants are claiming a method for smoothing and polishing a surface which involves remelting a to-be-smoothed surface using energetic radiation employing specific treatment parameters as claimed. Smeggil et al, on the other hand, do

not even recognize the problem that the Applicants solve and Smeggil et al do not address a need in the art for the Applicants' invention. Applicants demonstrate that there is a need in the art for a method for smoothing and polishing surfaces that "does not require expensive measuring instruments and can be used to automatically polish any three-dimensional surface, in particular metal surfaces, quickly and inexpensively" (See Specification page 3, paragraph 2). Smeggil et al do not address any of the issues that the Applicants address. Applicants respectfully submit that the claimed invention is not rendered obvious to a person having ordinary skill in the art in light of Smeggil et al. A person of ordinary skill in the art would have no reason to consider the teachings of Smeggil et al and a person of ordinary skill in the art would not have been able to predict the results of the claimed invention.

Based on the above, applicants respectfully submit that there is no adequate reason for a person having ordinary skill in the art of smoothing and polishing a surface to modify the AAPA described in the present application either with the teachings of Smeggil et al or other, unspecified, general knowledge of process parameters and developments in the laser art, as suggested in the examiner's action. Furthermore, even if Smeggil et al were considered by a person skilled in the art of smoothing and polishing, this reference does not teach the process parameters of Claim 1.

In view of the above, it is respectfully submitted that Claim 1 is patentable over AAPA and Smeggil et al. Claims 2-16 depend from and incorporate the subject matter of Claim 1 and are submitted to be patentable for at least the same reasons as Claim 1.

Furthermore, nothing in the AAPA and Smeggil et al would suggest the second treatment step in Claim 2 which recites "leveling micro-roughness remaining on said surface...by remelting the micro-roughness...employing second treatment parameters

down to a second remelting depth and by evaporating roughness peaks, wherein the second remelting depth is less than said first remelting depth." Claim 2 is believed to be patentable for at least this additional reason.

**B. AAPA AS COMBINED WITH SMEGGIL ET AL AND MUKAI ET AL.**

At the top of page 4 of the Office Action, claims 2, 4, and 6 – 16 are rejected under 35 U.S.C. § 103(a) as being unpatentable over AAPA in view of Smeggil, and further in view of U.S. Patent No. 5,232,674 to Mukai et al. As discussed above, applicants submit that Claims 1-16 are patentable over the AAPA and Smeggil et al. It is further submitted that Mukai et al add nothing to address the deficiencies of the combination of the AAPA and Smeggil et al noted above. Therefore Claims 2, 4 and 6-16 are submitted to be patentable for at least the same reasons as Claim 1.

Moreover, Mukai et al do not teach the second treatment step as recited in Claim 2 whereby micro-roughness remaining on the surface after a first treatment step is leveled by remelting down to a second remelting depth, which is less than the first remelting depth, and by evaporating roughness peaks. That is, the energetic radiation in the second step is selected so that the micro-roughness is leveled and roughness peaks are evaporated. Claim 2 is therefore submitted to be patentable over AAPA, Smeggil et al and Mukai et al for at least this additional reason.

Mukai et al disclose a method for improving the surface morphology of laser irradiated surfaces and in particular by irradiating the surface of an interconnection material on a semiconductor device. The method aims at eliminating problems connected with deterioration generated in the surface of an interconnection layer leading to a disconnection of the interconnected materials "and avoiding an undesirable post heating

effect and accordingly prevent the conductor material from evaporating after a number of pulse laser irradiations" (Column 2, lines 27-42). Mukai et al teach a first method step of irradiating a pulse laser beam on a region of a conductor material formed on an under layer to melt the entire conductor layer. However, upon solidification, the entire conductor layer is not smooth according to Mukai et al because the conductor layer contracts in the periphery of nucleation sites 4, and depressions 5 are formed at the surface of the conductor layer as shown, for example, in Figure 2A, thereby deteriorating the surface morphology. Mukai et al teach a second method step of irradiating a pulse laser beam on the irradiated region of the conductor layer such that only a surface portion of the conductor layer melts in a substantially entire irradiated region. The second step irradiates the pulse laser at a second energy level which is lower than the energy level of the irradiation in the first step. The second laser irradiation melts only a surface portion of the conductor layers such that the melt flows into the depressions 5 to improve the surface morphology. However, as noted above, Mukai et al do not teach employing treatment parameters in the second irradiation step that not only remelts down to a second remelting depth, but also evaporates roughness peaks, as required by the treatment parameters of the second treatment according to Applicants' Claim 2. Accordingly, Claim 2 is submitted to be patentable for at least this additional reason.

**C. AAPA AS COMBINED WITH SMEGGIL ET AL AND WRBA ET AL.**

At the bottom of page 4, Claim 12 is rejected under 35 U.S.C. § 103(a) as being unpatentable over AAPA in view of Smeggil et al, and further in view of U.S. Patent No. 6,670,575 to Wrba et al. As demonstrated above, Applicants respectfully submit that the claims are patentable over Smeggil et al for at least the foregoing reasons. It is submitted



that Wrba et al fail to cure the deficiencies of AAPA and Smeggil et al, so that claim 12, which depends from claim 1, is patentable for at least the same reasons as claim 1.

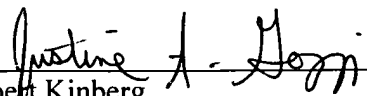
**CONCLUSION**

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant, therefore, respectfully requests that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. Applicant believes that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is hereby invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment is respectfully requested.

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Respectfully submitted,

By   
Robert Kinberg

Registration No.: 26,924

Justine A. Gozzi

Registration No.: 60,513

VENABLE LLP

P.O. Box 34385

Washington, DC 20043-9998

(202) 344-4000

(202) 344-8300 (Fax)

Attorney/Agent For Applicant